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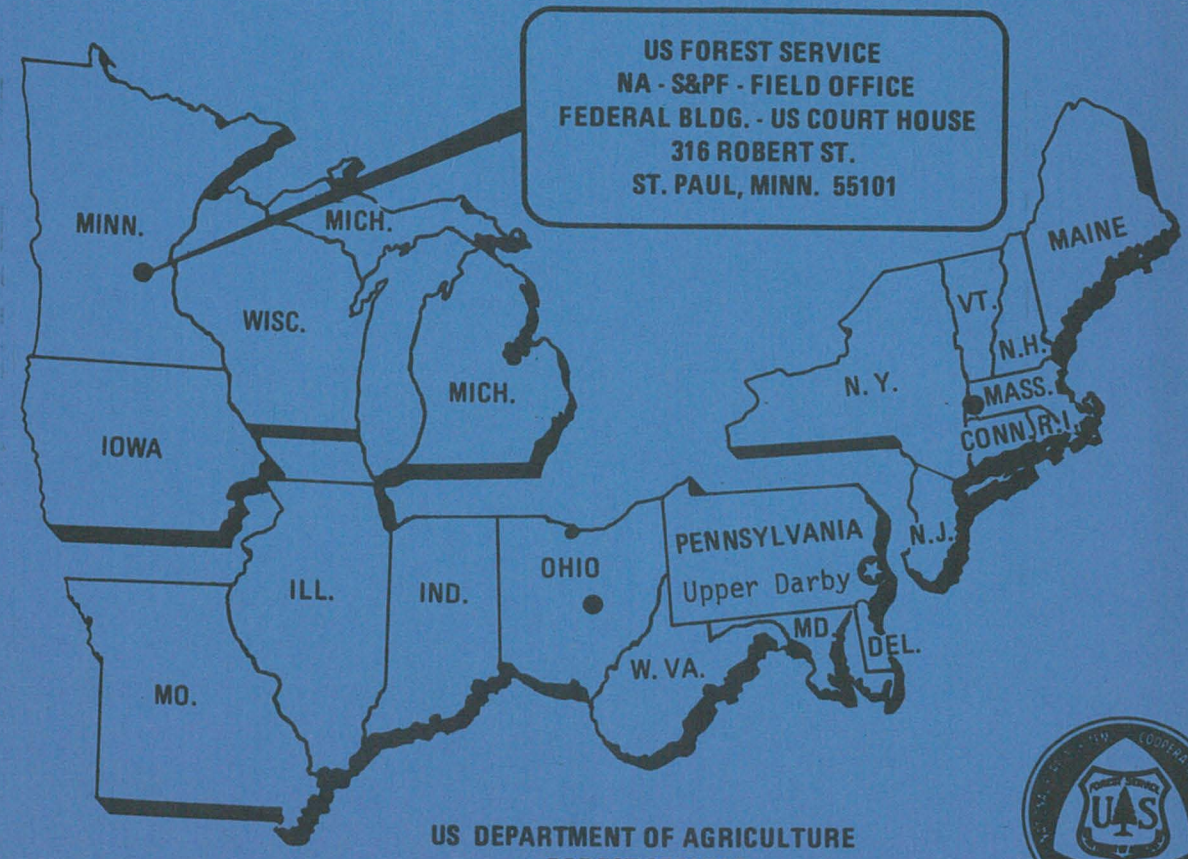
SARATOGA SPITTLEBUG SCAR-COUNT
SURVEY RESULTS FROM THE
HURON-MANISTEE NATIONAL FORESTS
MICHIGAN, 1970

By Imants Millers



US DEPARTMENT OF AGRICULTURE
FOREST SERVICE

SARATOGA SPITTLEBUG SCAR -COUNT SURVEY RESULTS FROM THE HURON-MANISTEE NATIONAL FORESTS MICHIGAN, 1970

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ABSTRACT

Saratoga spittlebug, Aphrophora saratogensis (Fitch), surveys were completed on 19,000 acres in 206 red pine plantations on the Huron-Manistee National Forests. High spittlebug populations were found in 29 plantations, covering 2240 acres. Tree mortality is likely to occur unless chemical suppression is applied. Areas with lower scar-counts should be re-surveyed within the next four years.

INTRODUCTION

The Saratoga spittlebug, Aphrophora saratogensis (Fitch), is one of the major pests of young pine plantations in the Lake States. Although spittlebug-like damage was reported from the Huron National Forest in the late 1930's, the causal organism was not identified until the early 1940's (Anderson 1947; Secrest, 1944). Since then, Saratoga spittlebug damage has been reported almost every year somewhere in the Lake States. From mid 1940's until early 1960's the recommended control was DDT, about 1 lb. per acre, applied from the air (Ewan, 1961). Later good control has been achieved with malathion (Fowler, 1968). Probably a result of the control efforts, plantations are rarely reported lost from spittlebug damage. The last spray project on the Huron-Manistee occurred in 1968 on the Harrisville Ranger District, when about 4800 acres were sprayed (Fowler, 1968).

Saratoga spittlebug is present in most plantations at low numbers. Outbreaks develop when favorable ecological conditions are present. Adult feeding scars (scar-counts) are used to estimate spittlebug damage after most of the season's feeding is finished from late fall until early spring.

BIOLOGICAL REVIEW

A. Causal Agent

The Saratoga spittlebug, Aphrophora saratogensis (Fitch)

B. Host

Adult spittlebugs feed on red pine, Pinus resinosa Ait., and other pines. The nymphs feed on low woody shrubs and herbs, of which the sweetfern, Comptonia spp. is preferred. Pine is considered the primary host because of economic values although both hosts can be killed by the spittlebug.

C. Type of Damage

The adult spittlebugs feed on 1-5 year old needle-bearing branches of pine. Necrotic areas, called scars, are produced in the bark (phloem and cambium) and wood (xylem). An early sign of damage is reduced growth of the leader which occurs when about 35 scars are found in the wood per 4 linear inches of twig. Continued damage causes stunted tree growth and increased taper of the trunk(Benjamin et al, 1953). About two years of heavy feeding results in twig mortality, called flagging with damage symptoms more noticeable in the upper crown. Three or more years of heavy spittlebug feeding is likely to result in top-kill or even death of the whole tree. Generally, pines between 2-15 ft. in height are most susceptible to mortality. Plantations in excess of 100 acres have been reported lost from spittlebug damage (Anderson, 1947; Secrest, 1944).

The long term effects of heavy spittlebug feeding on the tree are reduced quality and quantity in a tree as well as plantation. Stunting is likely to increase the taper of the trunk, increase the number of branch whorls per foot and increase the size of the branches. Flagging and top-kill may cause forking and crooking of the trunk. Tree mortality usually is in pockets where practically all trees are killed.

Stunting and branch mortality causes poor form of the tree trunk. When the leader, or larger portions of the top are killed, forking and crooking of the trunk is likely to occur.

D. Ecological Considerations

Briefly, the life history of the spittlebug is as follows (from Anderson, 1947). The adults lay eggs in the fall under scales of large buds - hardwoods as well as pines. In the spring, the eggs hatch and the nymphs drop to the ground. At first the nymphs feed and form spittle masses at the root collar of succulent herbs and sweetfern shoots. As the nymphs grow they move to larger woody shrubs, however, sweetfern is preferred. By the end of July, the 5th instar nymphs transform to adults and move to pines for feeding and oviposition.

Spittlebug abundance is related to availability of the host and alternate hosts (Ewan, 1961). Generally, red pine in the Lake States is susceptible to damage when the trees are 2 ft. to 15 ft. in height. A red pine stand becomes less susceptible to damage when crown closure reduces availability of alternate hosts. By causing tree stunting and mortality, uncontrolled spittlebug populations are able to maintain open red pine stands and thus prolong outbreak conditions. Similarily, other red pine pests, such as white grub, Scleroderris pine canker and defoliators may also produce plantation conditions favorable for spittlebug outbreaks.

Weather is another ecological factor that affects spittlebug populations (Ewan, 1961). The nymphs are susceptible to freezing at about 27°F, but usually, the air temperature must drop in the low 20's before the nymphs are killed at the root collars. Also, the nymphs are susceptible to desication during migrations - first from red pine to herbaceous plants, and later to woody shrubs.

A few parasites and predators are reported for Saratoga spittlebug but none effectively reduce outbreak populations (Ewan, 1961).

SURVEY METHODS

Scar-count surveys were made to detect and evaluate Saratoga spittlebug outbreaks. The plantations were selected from the Saratoga spittlebug Survey Atlas at St. Paul. Instructions for the survey were provided by

the Forest Pest Control Staff, but the field work was done by the Ranger District personnel.

The survey procedure is as follows. About 20 samples are taken in each plantation. Each sample is a count, or an estimate of scars in the wood of 4-inch section of a twig taken from the penultimate internode of an upper crown branch. Usually, the scar counts are estimated and recorded to the nearest 10. When the estimated number of scars exceeded 35, the sample was recorded as 35+. For analytical purposes, the damage was grouped into 3 classes as follows:

light - 14 scars or less
moderate - 15-29 scars
heavy - 30 or more when actual counts were made;
or 35+ when the counts were estimated.

When the survey shows that a portion of a plantation (at least 10 acres) is heavily damaged, the whole plantation is recommended for control. More intensive surveys before suppression are needed to determine the seriousness of the outbreak. When a geographical area appears to have an outbreak situation, all susceptible red pine plantations in the area should be examined for spittlebug damage.

RESULTS

Almost 19,000 acres in 206 plantations were examined for Saratoga spittlebug damage on the Huron-Manistee National Forest (Table I). Re-surveys are recommended on about 12,000 acres in 126 plantations. The recommended year of re-survey is determined from the abundance of scars and the estimated time for build-up to severe damage. Of the re-survey acreage, 2240 acres in 20 plantations have sufficiently high infestations to cause damage next year, and consequently, these areas are recommended for spittlebug control, if a satisfactory cost-benefit relationship can be determined.

Low spittlebug hazard conditions, such as tall trees and lack of alternate hosts, were present on 3642 acres in 33 plantations. These areas should be dropped from future surveys. About 1200 acres, 12 plantations, have hardwood overstory that usually prevents spittlebug build-up because of reduced tree growth. These plantations can be deleted from future surveys until the overstory is removed.

Finally, about 1900 acres in 40 plantations have low stocking of red pine or the size of plantations are too small for red pine management. The District Rangers have recommended that these plantations be dropped from future surveys.

DISCUSSION

The size of an infestation, or the severity of damage, in a plantation recommended for nymphal survey is indicated by the number of plots with

heavy and moderate scar counts (Table II). Each sample plot represents up to 10 acres (The acreage divided by the number of sample plots in the plantation). More intense scar count sampling is recommended for plantations considered for suppression. Evaluation of plantations by Forest Pest Control scientists can determine how long the damage has been present in the plantation and more accurately estimate the extent of the severely damaged areas (pockets). Nymphal surveys in late June and early July determine the status of outbreak populations. The final entomological decision of whether to spray or not is made on the basis of the adult spittlebug population found in the prespray surveys. The damage caused by Saratoga spittlebug feeding on red pine is reported by Anderson (1945), Benjamin et al, (1953) and Ewan(1961). The severity of the damage is dependent on the density of scars on the twigs, and the period, i.e. number of years, that the feeding damage has occurred. Usually, light feeding causes negligible effect and it is not visually perceptible in the field without dissection. Moderate scar density over a period of several years, as well as heavy feeding damage in one year results in reduced height growth, i.e. stunting. Spittlebug caused stunting differs from drouth, in that height growth is more reduced than growth of lower branches. Diameter growth in the lower trunk apparently is not reduced until the tree is practically killed.

Heavy spittlebug feeding for 2-3 years causes mortality of lateral branches, i.e. flagging, and top-kill. Additional years of feeding damage result in the death of the whole tree. Saratoga spittlebug outbreaks in red pine plantation typically develop in small areas within a plantation, called pockets. Local climate(microclimate), condition of hosts and alternate hosts, are the probable causes for outbreak development. As the outbreak progresses, these pockets converge so that the whole plantation may be destroyed. Total plantation destruction was reported before intensive surveys and spittlebug control projects were initiated in 1945 (Anderson, 1947; Secrest, 1944). Forest Service memoranda (in files at our office) indicate that severe spittlebug damage on the Huron-Manistee National Forest occurred in early 1940's and early 1950's. On the basis of field observations, some of the older CCC plantations on Tawas Ranger District had severe spittlebug damage in the late 1930's that caused high tree mortality, crooks and forks in plantations. These outbreaks were not reported, since the Saratoga spittlebug was "discovered" only in 1941 (Secrest, 1944).

SUPPRESSION INFORMATION

Malathion, applied at 10 fl. oz. per acre as ultra-low volume spray, is recommended for Saratoga spittlebug control. The insecticide is applied from aircraft when the majority of the spittlebugs are adults - usually in late July or early August. The estimated cost of about 1000 acre control project is $5.00 per acre for insect surveys, marking, insecticide and application costs. Malathion is a relatively safe insecticide at the recommended rates. However, normal safety precautions such as avoiding human contact and spraying open water should be observed. Special precautions should be exercised near apiaries, since bee mortality has been reported. Avoid spraying fine mist on acrylic and nitro-cellulose lacquer and Alkyd super-enamel(automobile) surfaces because malathion can act as a paint solvent.

TABLE I. Summary of Scar-count Survey Accomplishments and FPC Recommendations for the Huron-Manistee National Forests - 1970

DISTRICT	PLANTATIONS SURVEYED NO.	PLANTATIONS SURVEYED ACRES	RECOMMENDED NYMPHAL NO.	RECOMMENDED NYMPHAL ACRES	RECOMMENDED SC - '72* NO.	RECOMMENDED SC - '72* ACRES	RECOMMENDED SC - '73 NO.	RECOMMENDED SC - '73 ACRES	RESURVEYS SC - '74 NO.	RESURVEYS SC - '74 ACRES	RESURVEYS SC - '75 NO.	RESURVEYS SC - '75 ACRES	DROP FROM FURTHER SURVEYS LOW HAZZARD NO.	DROP FROM FURTHER SURVEYS LOW HAZZARD ACRES	UNTIL RELEASE NO.	UNTIL RELEASE ACRES	LOW STOCKING NO.	LOW STOCKING ACRES	AREA TO SMALL NO.	AREA TO SMALL ACRES
CADILLAC	15	1307	3	193	-	-	2	88	1	67	7	709	-	-	2	250	-	-	-	-
BALDWIN	19	3042	-	-	-	-	1	192	2	260	2	92	19	2498	-	-	-	-	-	-
MANISTEE	45	2995	2	39	-	-	6	550	4	399	5	369	3	170	6	455	19	1013	-	-
W. CLOUD	18	853	5	240	4	173	3	55	2	129	4	256	-	-	-	-	-	-	-	-
MIO	56	5738	10	681	11	2111**	3	103	11	1169	5	621	7	445	3	439	3	95	3	74
TAWAS	53	5052	9	1087	6	685	7	934	6	406	5	634	4	529	1	60	10	667***	5	50
	206	18,987	29	2240	21	2969	22	1922	26	2430	28	2681	33	3642	12	1204	32	1775	8	124

* Scar-count survey in a given fiscal year.

** Includes 5 plantations, 1143 acres that need rechecking because of red pine mortality, but low scar counts.

*** Only 3 plantations, 100 a, are failures; 7 plantations, 567 acres, are jack-red pine mixture not managed for red pine.

TABLE II. Red Pine Plantations With Heavy Saratoga Spittlebug Damage - 1970

LOCATION				PLANTATION DATA		NO. PLOTS BY DAMAGE CLASSES		
Comp. - Stand	T	R	S	Area Acres	Height Feet	Heavy	Moderate	Light
CADILLAC R.D.								
34 and 35	22N	13W	13 S½	69	5	11	10	8
101 and 98	20N	11W	6SW	40	4	13	2	5
113-5	21N	10W	33NW	84	5	6	2	22
				193				
MANISTEE R.D.								
52	20N	17W	33	30	4	5	4	9
52	20N	17W	28	9	3	4	4	1
				39				
WHITE CLOUD R.D.								
83	14N	13W	6NW	22	5	12	3	5
20	13N	16W	5SE	40	7	5	0	1
20	13N	16W	5/6 N/2	123	7	13	1	9
178	12N	10W	19/20	23	7	3	2	15
53	11N	15W	31NW	32	6	7	5	8
				240				
MIO R.D.								
69-19	26N	1W	24W	67	4	20	0	0
67-12	26N	1W	14NW	30	4	6	7	7
63-1	26N	1W	23NE	60	6	13	6	1
61-15	26N	1W	28	24	4	10	7	3
63-31	26N	1W	26SW	45	3	8	4	3
89-49	26N	1E	28	38	4	9	4	7
20-5/6	25N	3E	9/10S	90	6	18	5	7
152-3	25N	2E	32NE	20	10	6	3	1
204-16	25N	3E	24	202	5	13	5	7
146-134	25N	2E	8/17	105	4	22	4	4
				681				
TAWAS R.D.								
P-151	23N	6	5/8	240	6	22	13	3
P-156	23N	6	9	330	6	10	18	7
P-1576	23N	6	8/9	83	6	11	12	0
P-146	23N	6	5/8	123	8	13	8	4
P-152	23N	6	8	60	6	6	2	2
P-158d	24N	5	19/20	66	5	5	6	7
P-159	24N	5	20	75	4	5	11	3
P-62,63	24N	6	7/8	30	5	14	3	0
P-142	23N	6	11/14	80	8	5	4	2
				1087				

RECOMMENDATIONS

1. High spittlebug infestations are present in 29 plantations covering 2240 acres. Chemical suppression is recommended on the basis of the biological evaluation. However, the Forest Staff has indicated that no suppression will be proposed in 1971.

2. About 12,000 acres in 126 plantations are recommended for re-surveys. However, the Forest Staff has suspended spittlebug surveys until re-evaluation of the spittlebug problem is completed. A list of the plantations and recommended years of re-survey will be provided upon request.

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